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BLOOMINGTON, Ill. – This fall, an assistant professor of physics at Illinois Wesleyan University plans to have students help research one of the biggest questions facing science today: What is dark energy?

According to Assistant Professor of Physics Thushara Perera, studies involving dark matter and dark energy are showing there is more that is unknown in the universe than known. "Everything we know about the universe is probably 5 percent of what is really out there," he said. "Dark matter is maybe 25 percent, and the other 70 percent is probably dark energy."

Highly sensitive cameras, filled with detectors, are set in dry places at high elevation in an attempt to reveal the nature of dark energy and the history of the universe. Perera has spent years working on such a camera, known as the Astronomical Thermal Emission Camera (AzTEC), which was mounted on a telescope in the mountains of Chile. "The data from AzTEC helps answer fundamental questions about early galaxies and how they formed," said Perera from his office at Illinois Wesleyan, where he started teaching in 2008.

Perera was a research associate for AzTEC at the University of Massachusetts at Amherst during his recent postdoctoral studies. He is continuing his work with AzTEC by analyzing data the camera collects, and by building and designing hardware for future cameras. He plans to have undergraduate students at Illinois Wesleyan help with the data analysis as well the construction of hardware.

Dark matter and dark energy are, in essence, parts of the universe humans cannot see, and have not yet been able to fully detect, according to Perera. "From our studies of the universe and an understanding of gravity, we know there is something else out there," said Perera, who came to the United States in 1990 from his homeland Sri Lanka to study astronomy and physics. After graduating from Ohio Wesleyan University in 1994, he earned a master's degree and doctorate from Case Western Reserve University, where he began research on dark matter.

Dark energy (nicknamed "anti-gravity") and dark matter are relatively new concepts in science. Though theories from Albert Einstein help support the idea, it wasn't until the 1980s and 1990s that scientists began significant searches for dark matter and dark energy after studies showed the expansion of the universe was accelerating, which contradicted the conventional wisdom of the original Big Bang Theory. "These experiments showed the universe has been expanding faster than it had been in earlier times," said Perera, who noted dark matter is just like other matter in that it pulls objects into gravitation. "But if it was just dark matter out there, it would be attracting other things in the universe to it, not this seeming repulsion that causes things to accelerate away from each other."

Scientists know something is out there from the evidence of gravitational pull, but no one is certain what it is. Dark matter itself has not been detected by scientists, though teams are trying

to find ways to do just that. The massive CERN project in Switzerland is attempting to replicate conditions in which scientists think dark matter is created.

Instruments similar to AzTEC look for dark energy by exploring the patterns around ancient light. These instruments are sensitive enough to examine light wavelengths from early in the universe, approximately 300,000 years after the Big Bang, which scientists believe happened around 13.7 billion years ago. “The aging process of the universe stretches ancient light, and you have to go through a lot of trouble to see it,” said Perera. “But that light is critical to understanding the formation of the universe.”

Currently, much of the work on dark energy is centered at large, research universities. Perera hopes the efforts of he and his students will open the doors for dark energy to be studied at smaller universities. “If students and I are able to make an optical filter that is useful for instruments being built at several large institutions, that would be an example of a small university making an important contribution to this field,” said Perera.

Though Perera’s work in cosmology attempts to understand the origin of the universe, he said he has no illusion that humans will ever have all the answers. “My research has been based on finding the missing elements of the universe,” he said. “It is a search for a deeper understanding, taking me back further in time until maybe the beginning of the universe. But will we know what happened before the Big Bang, before time and space began? I don’t think so.”

Perera paused and smiled, “but I don’t want to exclude it either.”

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